s c o t t

TEST STANDARD

MODEL 320R
330R
330RL

RECEIVER

September 8, 1978

Model 320R, 330R and 330RL Alignment Specifications

1. Scope

This specifications shall apply to the alignment for the stereo receivers, Models 320R, 330R and 330RL.

When conducting the alignment by not using the test equipment or the procedures described in this specifications, an approval shall be obtained from design engineering section.

2. Alignment Conditions

2.1 Atmospheric Conditions

Reference temperature and relative humidity are

25°C, 65%

but unless otherwise noted, the alignment may be conducted at room temperature & humidity (5 - 35°C, 45 - 85%).

2.2 Power Supply

Unless otherwise specified, AC power supply of 117V ± 1%, 60Hz ± 20% (220V ± 1%, for European Version), & THD of 2% or less shall be used. However, power supply of 50Hz may be used in the case where the power frequency does not give any affection. A care must be taken to voltage variation because of high power output of the test unit.

2.3 Alignment Equipment

The alignment equipment should be calibrated and have known accuracy required to measure the performance within the specific error described in "Test Specifications".

3. Descriptions on Controls & Standard Setting

3.I Operation of Controls

A. Input Selector

Rotary type switch, selects one of AM, FM, FM MUTE, PHONO & AUX input signals.

B. Mode

Determines the manner in which program material will be reproduced through the left and right channel.

With the switch placed "MONO" position, a program source connected to the left and right channel input jacks is mixed and reproduced through both channels during FM reception.

C. Volume and Balance

Volume : Dual knob type with 41 click stops, both L- and R-CH sound levels are varied simultaneously.

Clockwise rotation increases sound volume and counterclockwise rotation decreases.

Balance : Dual knob type with center click stop, clockwise rotation decreases left channel volume and vice versa. With 12 o'clock position L- and R-CH volumes are max.

D. Tone Control

Single knob type with 11 step clicks. Both channel are simultaneously controlled.

Bass : 10dB of boost and cut at 100Hz

Treble : 10dB of boost and cut at 10kHz

E. Tape Monitor

Selects outputs from tape deck connected to Tape Play input jacks.

With the switch placed "Tape" position, any stereo program source connected to the Tape Play inputs will be reproduced through the receiver regardless of Input Selector selections.

With the switch placed "Source" position, the program selected by

Input Selector will be reproduced through the receiver and heard in the speakers.

F. Hi FIL

Reduces high frequency noises. With the switch placed in "ON" position, the frequency response at 8kHz will be reduced by 6dB. (Attenuation characteristics : 6dB/Oct.)

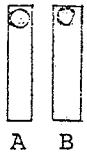
G. Loudness

Human ears feel a lack of high and low notes if the sound volume is set to a considerable low level. This switch compensates these reductions in high and low frequency regions.

With the Loudness switch placed in "ON" position, the level increases at 100Hz and 10kHz are about +7dB and +3.5dB, respectively, if the volume control is set to -30dB (a half or lower position from MAX.) position.

H. Speaker

This switches in the audio output to A, B & A+B terminals on rear panel, using two lever type switches.



: With both switches placed in "OFF" position, all (A- and B-speakers) speakers are silenced.

: With speaker A switch placed in A position (lever down), the sound output appears through the speakers connected to the speaker A output terminals.

: With speaker B switch placed in B position (lever down), the sound output appears through the speakers connected to the speaker B output terminals.

: With both switches placed in "A- and B-position, the sound output appears through the speaker A and B output terminals simultaneously.

However, the sudio output is always being supplied to the Phones jack on the front panel.

3.2 Standard Control Setting

A. Input Selector

Depending upon the measurement item.

B. Volume & Balance

Balance : 12 o'clock position (center click).

Volume : For Tuner alignment at MIN.

For Main amplifier alignment at MAX.

For all other alignments at MIN.

C. Tone Control

All controls (Bass & Treble) in 12 o'clock position.

D. Monitor

In Source position.

E. Hi FIL

In OFF position.

F. Loudness

In OFF position.

G. Mode

Stereo

H. Speaker

A position, unless otherwise noted.

4. Preliminary Alignment

Before turning the power ON initially, set the controls as follows : (Especially care must be given not to damage the power transistors in Main amplifier alignment).

4.1 Positions of trimming resistors

Temporarily place the trimming resistors.

A) RV1 (FM signal meter calibration) in center position.

B) RV2 (Mute level adjust) in center position.

c) RV3 (FM MPX separation adjust) in center position.

D) RV4 (VCO 76kHz adjust) in center position.

E) CT1, CT2 & CT3 (330RL ; Tracking & Covering adjust) in mid position.

F) CT4 & CT5 (320RL/330RL ; Tracking & Covering adjust) in mid position.

G) CTa, CTb, CTd & CTe (320R/330R ; Tracking & Covering adjust) 1-turn counterclockwise position at fully clockwise.

H) RV7 & RV8 (Main amplifier Idle current adjust) in fully counterclockwise position.

I) CTc (320R/330R ; FM local adjust) in mid position.

4.4 Wiring and Conduction Check

Check power supply and main amplifier circuits with a circuit tester or visual inspection.

Especially care must be given to the power transistors in the main amplifier, plus & minus B lines, Bridge circuit and ±22V line for short-circuits. Also check for incorrect polarity of Electrolytic Block Capacitor and wirings for the regulated power supply.

5. Alignment

The alignment should be performed in the sequence as shown below after complection of above preliminary works.

The main amplifier should not be powered for a long time before alignment.

The main amplifier must be aligned in First.

5.1 Equipment Required

1) Audio Signal Generator ; Frequency 20Hz to 200kHz variable output level, 0.5mV to 1V variable.

2) Level Meter ; Frequency Response, better than 20kHz, measurement range 0.5mV to 10V or higher.

3) Oscilloscope ; Input Sensitivity 1mV/cm or higher.

4) VTVM ; Capable of measuring 10mV - 50V, 100Hz.

5) Frequency Counter ; Measurement range 0 - 100kHz, High Input Impedance type.

6) Sweep Generator ; Sweep frequency, 455kHz ± 50kHz, 10.7MHz ± 1MHz.

7) Distortion Analyzer ; Frequency, 20Hz to 100kHz ± 0.5dB

8) FM Signal Generator [Multiplex Generator] ; Frequency, 1MHz to 200MHz variable, output level 0.5mV to 1V variable

9) AM Signal Generator ; Frequency, 150kHz to 400kHz/590kHz to 1700 kHz variable, output level 0.5mV to 1V variable.

10) Suitable Line Voltage and Current Monitoring Meters.

11) Variable Power Line Transformer

12) FM Dummy Antenna

13) DIN Antenna (330RL)

5.2 Alignment Procedures

5.2.1 Main Amplifier Alignment

1. Measure the voltage between pin 47 (and pin 48) on the PC Board PSAA004C0X and chassis, it should be 0V.
2. Next, couple a clamp-on current meter to the J-K lead (and J-L lead) on the PC Board and adjust RV7 and RV8 to obtain 40mA.

5.2.2 AM Tuner Alignment

A. AM IF Alignment

1. Place Selector switch in AM position.
2. Connect 455kHz sweep generator output between antenna terminal and chassis.
3. Connect an oscilloscope directly to pin 12 of IC3 and chassis.
4. Adjust T8 for maximum and symmetrical scope display as shown below.

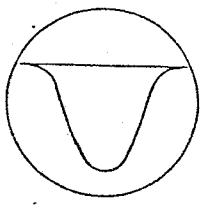


Figure 1. Scope Diaplay

B. AM Tuner Alignment (Tracking & Covering)

1. Connect the test equipment to 320R/ 330R/ 330RL as shown in Figure 2, "AM Tuner Alignment Setup".
2. Place AM bar antenna in the correct position by pulling it outward.
3. Set AM signal generator frequency to 600kHz for 30% modulation at 1kHz with tuning dial pointer set to the same frequency.
4. Increase AM signal generator output untilaa sine wave appears on the oscilloscope display.

   Then, adjust T9 (Red) for maximum audio output (dial frequency alignment). Also, adjust screw core on AM bar antenna for maximum output (tracking alignment).

   [As regards model 330RL, adjusting screw core is provided on the right side of bar antenna at the view from the front].
5. Next, adjust AM signal generator frequency to 1400kHz and place the dial pointer in 1400kHz position.

   Adjust CTd [CT4] for maximum audio output (dial frequency alignment). Also, adjust CTe [CT1] for maximum output (tracking alignment).
7. Repeat above steps (at 600kHz and 1400kHz) until no further improvement is obtained.

Set AM signal generator frequency to 1000kHz with dial pointer set to the same frequency and verify that the frequency accuracy on the scale and sensitivity are within standard value.

Note : Symbol in [ ] parenthesis are applied to model 330RL in the above alignment.

When adjusting the cores or trimming capacitors, the audio output level will rapidly increase and the level meter pointer go off scale. In this case always decrease the signal generator output for proper audio output.

Do not change the level meter range to match the increased audio output. Keep AM signal generator output as low as possible to avoid AGC action during AM Tuner Alignment.

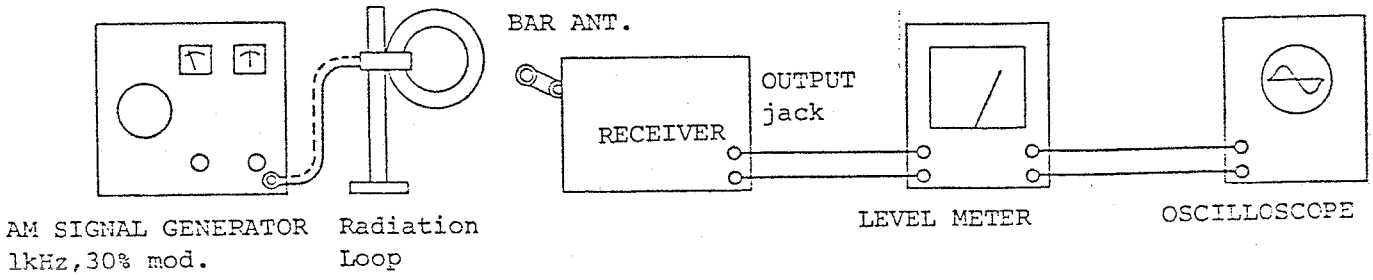


Figure 2. AM Tuner Alignment Setup

C. AM Signal Meter Calibration

The same test setup as above will be used.

1. Increase AM signal generator output to approximately 80 - 100dB.
2. Adjust RV5 for 90% deflection of the full scale.

5.2.3 LW Tuner Alignment [Model 330RL only]

A. LW Tuner Alignment

The same test setup as shown in Figure 2, AM Tuner Alignment Setup.

1. Place Selector switch in LW position.
2. Place bar antenna in the correct position by pulling it outward.
3. Adjust AM signal generator frequency to 170kHz for 30% modulation

at 400Hz with tuning dial pointer set to the same frequency.

4. Increase AM signal generator output until a sine wave appears on the scope display.
5. Adjust T10 for maximum audio output (dial frequency alignment). Also, adjust screw core (adjusting screw core is provided on the left side of bar antenna at the view from the front) for maximum output.
6. Next, adjust AM signal generator frequency to 320kHz and place the dial pointer in 320kHz.
   Adjust CT5 for maximum audio output (dial frequency alignment). Also, adjust CT2 for maximum output (tracking alignment).
7. Repeat above steps (at 170kHz and 320kHz) until no further improvement is obtained.
   Set AM signal generator frequency to 250kHz with dial pointer set to the same frequency and verify that that the frequency accuracy on the scale and sensitivity are within standard value.
   Note : The distance between the bar antenna and center of loop antenna shall be adjusted to 60cm.
   Actual antenna input voltage is given by[SG ATT output (dB) - 26 dB].

B. External Antenna Adjustment

1. Set EXT-IN antenna switch (S1) on rear panel to EXT position.
2. Adjust AM signal generator to 170kHz for 30% modulation at 400Hz with tuning dial pointer set to the same frequency.
   Adjust T1 for maximum output.
3. Adjust AM signal generator to 320kHz for 30% modulation at 400Hz with tuning dial pointer set to the same frequency.
   Adjust CT3 for maximum output.

Spec.	1.	170kHz	200uV (46dB)
S+N/N = 20dB	2.	250kHz	100uV (40dB)
	3.	320kHz	56uV (35dB)

5.2.4 FM IF Alignment

A. Center Meter Calibration

1. Place Selector switch in FM position.

2. Adjust T5 to bring the meter pointer on the exact center of Tuning Meter scale with no signal applied.

B. FM IF Alignment

1. Couple the output of the sweep generator to T2 (RF transformer) through a coupling coil (2 or 3 turns of vinyl wire) as shown in Figure 3.

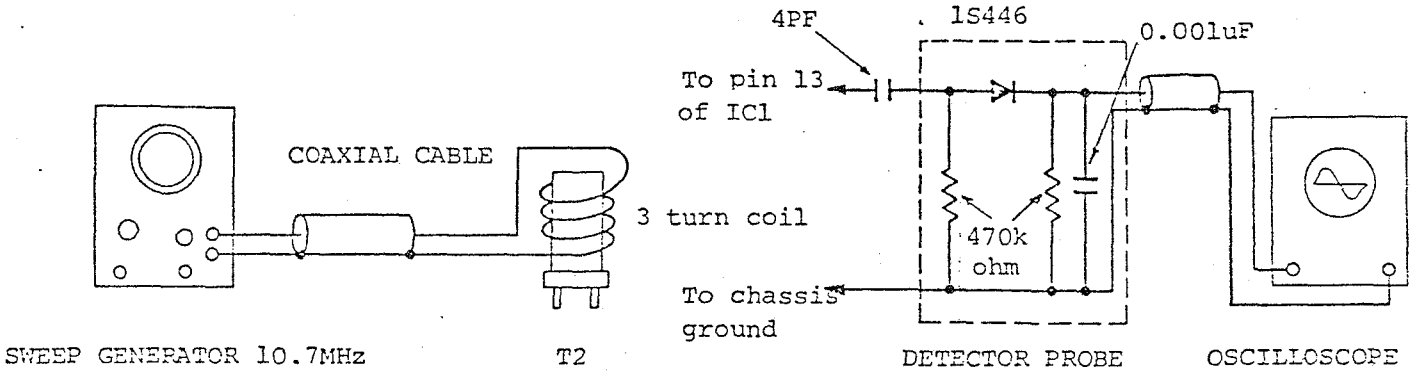


Figure 3.

Important : Do not ground the coaxial cable ground lead of sweep signal injection coil.

2. Connect the detector probe to the pin 13 of IC1 and chassis ground as shown above. The hot lead of the probe should be made as short as possible and the ground lead should be connected to chassis ground, the closest point to IC1.

3. Short-circuit the local oscillator by shorting the oscillator variable capacitor (CV3) using a 0.001uF ceramic capacitor.

4. Increase sweep generator to provide about a half of the saturation level as indicated on the oscilloscope display.

5. Adjust core of T4 for highest, widest and round top response as shown in Figure 4. (Since ceramic filter always use the one having the same color dot (same center frequency).

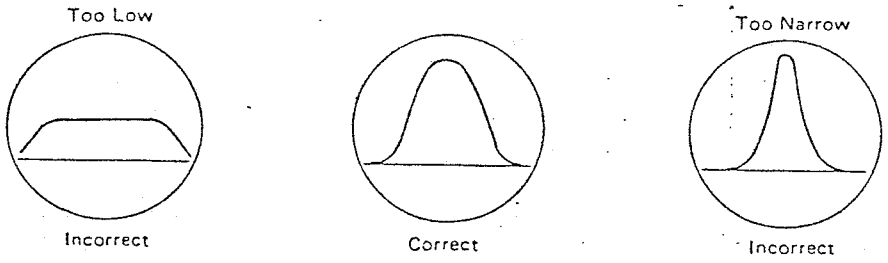


Figure 4. Scope Diaplay Waveforms

5.2.5 FM Front End Alignment

1. Set the Selector switch to FM position, and FM mute switch in OFF position.
2. Connect test equipment to 320R/330r/330RL as shown in Figure 5.

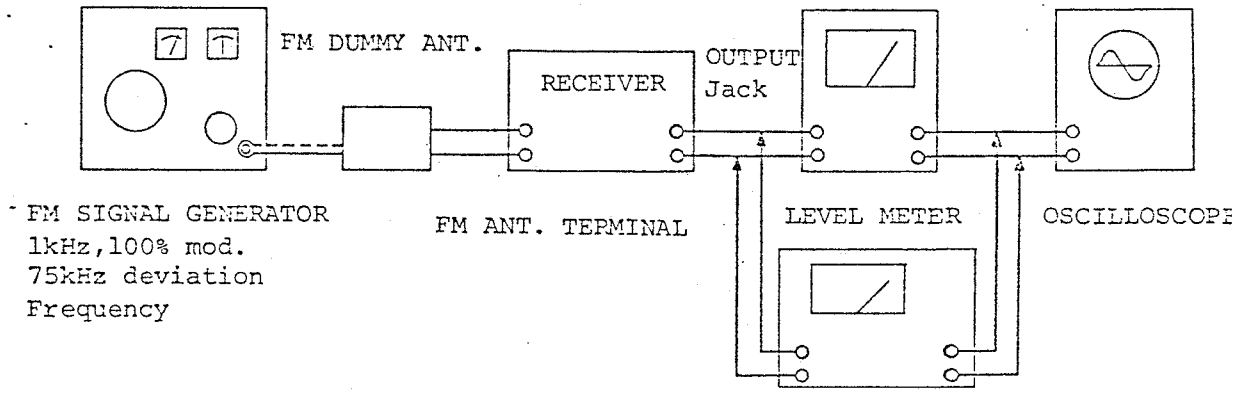


Figure 5. FM Front End Test Setup DISTORTION ANALYZER

3. Adjust FM signal generator frequency to 90MHz and tuning dial pointer to 90MHz. Then, adjust T3 to obtain symmetrical sine wave on scope display.
4. Alternately adjust Tl and T2 for maximum indication on level meter.
5. Adjust FM signal generator frequency to 106MHz with tuning dial pointer set to the same frequency. Adjust CTc to obtain maximum and symmetrical sine wave on scope display.
6. Alternately adjust CTa and CTb for maximum indication on level meter.
7. Repeat above steps 3 thru 6 until no further improvement may be obtained.
8. Set the receiver to 98MHz and check for frequency accuracy. The edge of dial pointer shall be over the specific frequency mark on the scale. Verify that the frequency accuracy and sensitivity are within standard.

The IHF sensitivity shall be 2.0uV for 320R, and 1.9uV for 330 and 330RL.

Note : When audio output is increased during alignment, always decrease FM signal generator output to such a level at which the sine wave on the scope includes visible noise pulses to avoid inaccurate alignment due to limiting action.

5.2.6 FM Distortion Alignment

1. Connect the test equipment to 320R/330R/330RL as shown in Figure 5, FM Front End Test Setup.
2. Verify that the tuning meter pointer indicates exact center of scale with no signal applied.
   If not, adjust T5 to bring the meter pointer on the exact center of tuning meter scale with no signal condition.
3. Then, adjust FM signal generator frequency to 98MHz.
   Using tuning control, tune the receiver to 98MHz so that the tuning meter pointer indicates exact center of scale.
4. Increase FM signal generator output level to 65dB (about 1mV).
5. Set the audio distortion analyzer to distortion position and adjust T6 for minimum distortion.
   Adjusting T6 may upset the tuning meter alignment slightly.
   So repeat steps 2 thru 5 a few times until no further improvement is obtained.

5.2.7 FM Signal Meter Calibration

1. Set FM signal generator frequency to 98MHz, 80 - 100dB output and tune the receiver to the same frequency.
2. Then, verify that the meter pointer deflects approximately 90%.
   If not, adjust RV1.

5.2.8 FM Mute Alignment

1. Turn the Muting switch ON and feed RF signal to the antenna input circuit from signal generator.
2. Increase signal generator output from zero to muting threshold level where audio output is just obtained at Tape Rec jacks.

   The threshold level shall be within 15dBf.

   If not, adjust RV2.

5.2.9 MPX Decoder Circuit Alignment

A. 76kHz Alignment

1. Set FM signal generator frequency to 98MHz and tune the receiver to the same frequency. Place the Muting switch in OFF position.
2. Adjust FM signal generator to provide 65dBf (1mV) antenna input with no modulation (no pilot signal of 19kHz should be included).
3. Connect a frequency counter at the point between TP (test point) and chassis ground and read the frequency.

   It should be 76kHz $\pm$ 200Hz. If not, adjust RV4 to obtain that reading.

B. Separation Alignment

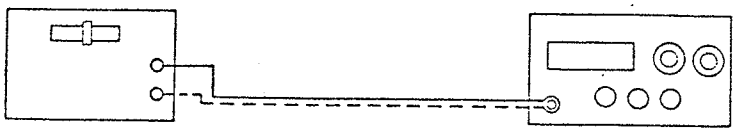
1. Modulate MPX signal generator with stereo composite signal (mod. f = 1kHz, 9% pilot signal, 6.75kHz dev.).
2. Tune the receiver exactly to the signal generator frequency using the tuning meter for tuning to exact center of channel.

   Then, increase the generator output up to about 65dBf (1mV).
3. Modulate MPX signal generator with the normal left channel composite signal and observe the output signal of the right channel Tape Rec jack. There should be very little leakage from the left channel.

   Adjust RV3 for minimum leakage voltage (separation).
4. Next, modulate MPX signal generator with right channel composite signal and observe the right channel signal leakage appeared on the left channel Tape Rec jack.

   The leakage voltage should have the same level as that of the right

channel. If not, readjust RV3 for equal and minimum voltage at both outputs. The normal leakage voltage (separation) is approximately 45 dB.

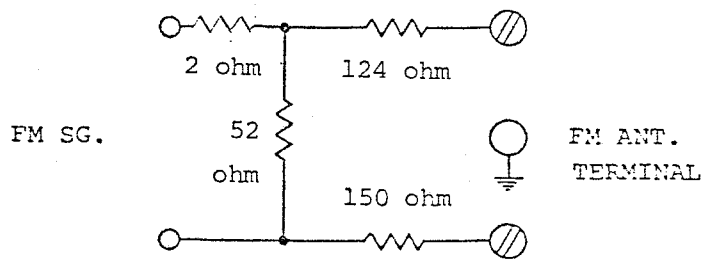


RECEIVER TP & Chassis ground FREQUENCY COUNTER

- 76 kHz ALIGNMENT -

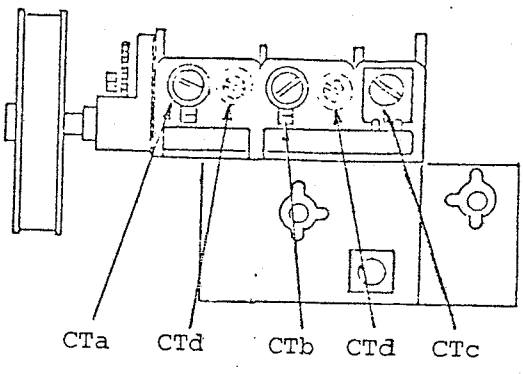
INFORMATION :

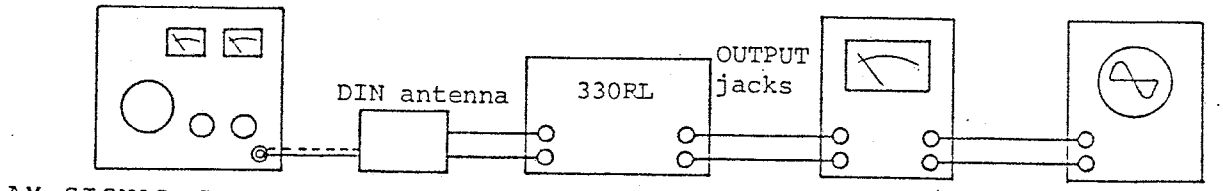
1. FM Dummy Antenna



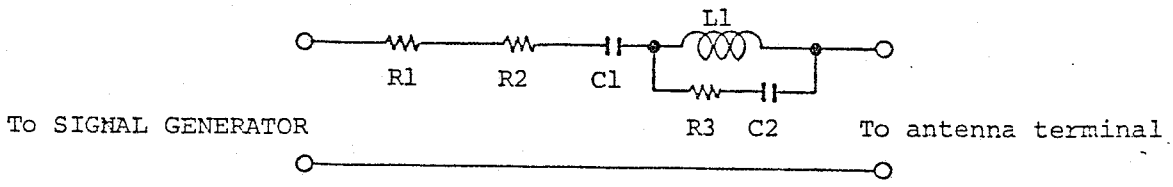
- FM DUMMY ANTENNA -

2. Alignment Points (VC trimmier)





- LW EXTERNAL ANTENNA ALIGNMENT -



- DIN ANTENNA (DUMMY ANTENNA) -

[R1 R2 = 80 ohm, R3 = 320 ohm, C1 (polystyren film) = 120 pF, C2 (polystren film) = 390 pF, L1 = 20 uH]

Figure 2-A.

SEPTEMBER 20, 1978

SCOTT MODEL 320R, 330R & 330RL RECEIVER

SERVICE INFORMATION
(ALIGNMENT PROCEDURES)

Test Specifications for Models 320R, 330R & 330RL

1. Scope

This specifications shall apply to the tests for FM stereo amplifiers, Model 320R, 330R & 330RL.

2. Test Conditions

2.1 Reference Temperature & Humidity

Reference Temperature and humidity are 25°C, 65%. However, the test may be conducted under room temperature (5 - 35°C) and room humidity (45 - 85%) unless otherwise specified.

When there is doubt on the test results or in case where repeatablity is required, the test shall be conducted in the place free from spurious radiations and transformer flux leakage under temperature of 25 $\pm$ 3°C and humidity of 65 $\pm$ 5%.

2.2 Power Supply

The Test power supply shall be 117V $\pm$ 1% (USA version), 220V $\pm$ 1% (Europe version), 60Hz $\pm$ 2% with wave shape distortion of 2 % or less. 50Hz power supply may be used for the test items which are not affected by the power supply frequency of 60 Hz.

The equipment using AC motor such as tape recorders, players, etc. shall be tested with the frequency specified.

2.3 Test Equipment

The test equipment shall be calibrated and has the required accuracy.

2.4 Test Method

Each test shall be conducted by referring to the new IHF method, however, the test items not based on the IHF method shall be performed according to this specifications.

2.5 Dummy Load

Dummy load shall be non-inductive, pure resistance, and be connected to the receiver with a copper wire of 0.8 mm dia.

Care should be given not to produce undesirable ground loop in connections between the test equipment and the receiver under test.

2.6 Source Impedance

Unless otherwise specified, the signal source inpedance shall be 600 Ohms.

3. Test Groups

The test shall be conducted in two ways, 100% test and sampling test. In the latter case, five units shall be sampled per day.

RECEIVER TEST

MW Section

When conducting test items 2 through 10, connect a dummy antenna consisting of 200pF capacitor between the signal generator and receiver antenna.

In this case, the receiver antenna input shall be read as the direct reading onthe generator's attenuator.

(1) Usable Sensitivity (100% Test) (Loop Antenna Method)

Check field strength which gives S+N/N 20dB sensitivity at each 600 KHz, 1000 KHz and 1400KHz.

The field strength should be within the following limits.

ANT - Output

400Hz, 30% Mod.

Distance between loop Antenna and bar antenna : 60cm

(SG Scale reading - 26 dB)

1. 600KHz : 51dB/m or less (350uV/m)
2. 1000KHz: 48dB/m or less (250uV/m)
3. 1400KHz: 51dB/m or less (350uV/m)

(2) S/N Ratio (Sampling) *

Signal input 1000KHz, 1mV (60 dB)

ANT - Output

400Hz, 30%

	320R	330R	330RL
1mV(60dB)	45dB or Higher	45dB or Higher	45dB or Higher

(3) Distortion (Sampling) *

Vary input signal level from 200uV to 10mV and measure distortion and output level variations.

They should be within the following limits.

ANT - Output

1000KHz, 400Hz 30% Mod.

(1) Distortion : 1.5% or Less (1mV input)

(2) Level Variation: $\pm$3 dB or less

(4) Output Level (100% Test)

f = 1000KHz, 1mV (60 dB) input

400Hz, 30 % Mod

Output levels for both channels should be within 300 mV $\pm$ 3 dB.

(5) Signal Meter (100% Test)

Vary antenna input signal level from 0 uV to 100mV (100 dB) and observe the meter deflection:

(6) Receive Frequency Accuracy (100% Test for 600, 1000 and 1400KHz, sampling test for remaining points)

Adjust a signal generator to provide frequency output of 550KHz, 600KHz, 700KHz, 800KHz, 900KHz, 1000KHz, 1200KHz, 1400KHz and 1600KHz, and tune the receiver in each of these frequencies. The dial pointer should be over the corresponding dial graduation.

(7) Receiver Frequency Range

510KHz - 1605KHz

(Alignment should be made for 505 - 1650KHz)

(8) Selectivity (Sampling)

Receive 1000KHz signal and obtain SN 10 dB input signal level and let it be (A) dB. Move the input signal frequency by $\pm$ 10KHz and increase the input signal level until the same output level (as the SN 10 dB output level) is obtained. And let the input signal level be (B) dB, then the selectivity at $\pm$20KHz will be given as

(B) dB — (A) dB.

Spec.	320R	40 dB or higher
	330R	"
	330RL	"

(Modulation : 400Hz, 30%)

(9) Frequency Response (Sampling)

Adjust signal generator to provide 1000KHz, 400Hz 30% modulation, 1mV output, and tune the receiver to the same frequency, noting the audio output level.

Increase the modulation frequency until the audio output decreases by 14 dB. Adjust the signal generator frequency slightly to obtain a minimum audio output(dip point). Thus, precision tuning has been established once, do not touch the frequency adjustment controls. Measure the frequency response by varying modulation frequency.

Spec.	320R	-3 dB, at 60Hz - 3KHz
	330R	"
	330RL	"

(10) Image Rejection (Sampling)

Receive 600KHz, 400Hz 30% mod. signal and decide the SN 10 dB input signal level and let it be (A) dB.

Next, adjust signal generator to produce image frequency (600KHz + 2 IF), 1510KHz and increase the signal output level until the receiver audio output increases to the same level as obtained at SN 10 dB input, and let the SG output be (B) dB. Then, the Image Rejection Ratio will be given as

(B) dB — (A) dB

Spec.	320R	40 dB at 600KHz
	330R	"
	330RL	"

* In testing items (2) S/N Ratio and (3) Distortion, tuning should be established as stated in (9) Frequency Response. Incorrect tuning will lower measurement accuracy.

LW Receiver Section (330RL)

A. Measurement with Radiating Loop Antenna

Place the radiation loop antenna so that the distance of 60 cm between the center of loop antenna and axis of receiver bar antenna is employed, then the field strength at the place of bar antenna is given as SG output -26 dB.

(1) Usable Sensitivity (100% Test)

Antenna input signal required to provide SN 20 dB output, modulation 400 Hz, 30%.

Spec.	1.	170KHz	54 dB/m (500 uV/m)
	2.	250KHz	52 dB/m (400 uV/m)
	3.	320KHz	54 dB/m (500 uV/m)

(2) Receive Frequency Range (100% Test)

Spec.	150KHz	-	360KHz	(Nominal)
	145KHz	-	370KHz	(Alignment)

(3) Image Rejection (Sampling)

Tune the receiver in 170KHz signal from the SG and decide the SG output level to produce SN 10dB output in the receiver. Let the SG output be (A) dB. Next, adjust SG to provide the image frequency and increase the output level until the same audio output as that of SN 10 dB audio output is obtained.

Let the SG output be (B) dB in this case. Then the Image Rejection Ratio will be given as

(B) dB — (A) dB.

Reference : 330RL 29 dB

(4) IF Rejection (Sampling)

Measure IF rejection in the similar way shown as above (3), except : IF frequency, 455KHz

Tuning frequency, 250KHz

Reference : 330RL 40 dB

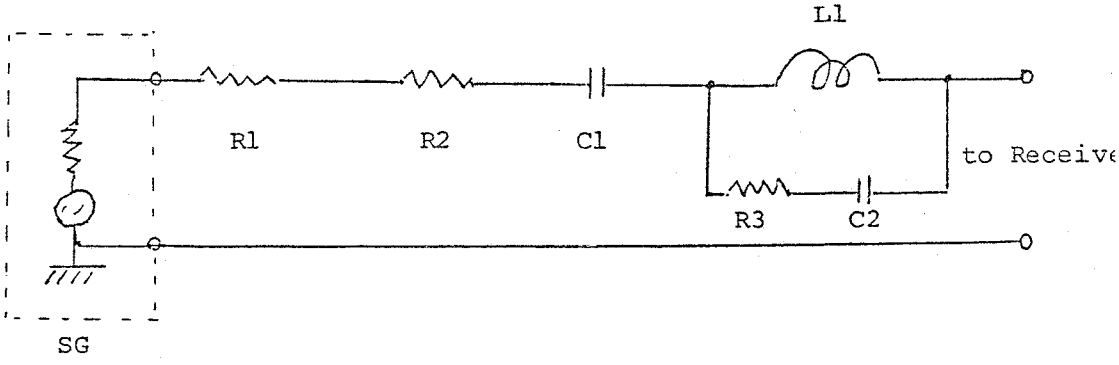
(5) Meter Sensitivity (100% Test)

Antenna Input to give indication "2" : 56 dB/m

Antenna Input to give indication "4.5 - 5": 100dB/m or higher

The Meter pointer should be over "0" at nosignal condition.

B. Measurement with Ext. (DIN) Antenna



R1 + R2 = 80 Ω

C1 (Polystyrene) = 120pF

C2 (Polystyrene) = 390pF

R3 = 320

L1 = 20uH

(1) Usable Sensitivity (100% Test)

Antenna input voltage required to produce SN 20 dB audio output.

Spec.	Reference Values :
400Hz, 30% Mod.	1. 170KHz : 120uV
	2. 250KHz : 70uV
	3. 320KHz: 60uV

(2) Image Rejection (Sampling)

Measure the image rejection in the similar way as stated previously under "(3) Image Rejection", except using the dummy antenna instead of theloop antenna.

Reference value : (25 dB) at 170KHz

(3) IF Rejection (Sampling)

Measure IF rejection in the simlar way as stated previously under "(4) IF Rejection", except using the dummy antenna instead of the loop antenna.

Reference value : (30 dB) at 250KHz

(4) Output Level (Sampling)

Spec. 300mV $\pm$ 3 dB

at 400Hz, 30 % Mod, 1mV input

(5) Signal to Noise Ratio (Sampling)

Adjust SG to provide 250KHz, 1mV output and tune the receiver to the same frequency.

Then establish correct tuning as previously stated under "(9) Frequency Response".

Measure the signal to noise ratio.

Spec. (40 dB) (400Hz, 30% Mod.)

(Reference)

(6) Signal Meter (Sampling)

Referene : Antenna input required to give meter deflection of "2" : 45 dB.

Antenna input required to give meter deflection of "4.5 - 5" : 110 dB

Meter pointer should be over "0" at no signal condition.

Note : Though DIN Antenna is employed in the above measurements, the measurement method used is not the same as DIN method.

FM Receiver Section

(1) Usable Sensitivity (100% Test)

Measure antenna input signal voltage required to produce 30 dB distortion in the audio output at each input frequency of 90 MHz, 98 MHz and 106 MHz.

They should be less than the values shown in the table below:

Conditions :

FM ANT - REC OUT
1000Hz, 100% Mod
(75KHz dev.)

	dBf	dB (uV)
320R	12.0	2.2 uV
330R	12.0	2.2 uV
330RL	12.0	2.2 uV

(2) Signal to Noise Ratio (Sampling)

Adjust SG to provide 98MHz, 65 dBf input and tune the receiver to the same frequency and measure the Rec. output. Turn off the signal generator modulation and measure the signal to noise ratio.

They should be within the following limits.

Conditions :
ANT-Rec. Output
1KHz, 75KH dev.
BPF(200Hz - 15KHz) used
L & R CH should be
measured separately.

	MONO	STEREO
320R	70 dB	65 dB
330R	70 dB	65 dB
330RL	70 dB	65 dB

(3) Output Level (Sampling)

The Fixed Rec. Output should be within

$0.775V \pm 3$ dB (0.54 - 1.085V)

When measured with input signal of 98MHz, 65 dBf, 1000Hz, 75KHz deviation.

(4) Distortion (100% Test)

Conditions :
ANT - Rec. Output
98MHz, 65 dBf input
75KHz deviation
BPF (200Hz - 15KHz) used
in case of stereo
measurement.

Model / Item	320R	330R	330RL
MONO	0.15 %	0.15 %	0.15 %
STEREO	0.3 %	0.3 %	0.3 %

(5) Signal Meter (100 % Test)

Vary the antenna input signal from 0 to 100mV and observe:

1. Input voltage required to give reading of "2"
2. Max. meter deflection at 100mV input.

They should be within the following limits.

	320R	330R	330RL
1. Input Volt to give "2" deflection	—	20-35 dBf	20-35 dBf
2. Max. deflection	70-90 %	70-90 %	70-90 %

(6) Receive Frequency Accuracy (100 % Test for 90, 98 & 106MHz ; Sampling test for the remaining points)

Adjust SG to provide 88, 90, 92, 94, 96, 98, 100, 102, 104, 106 & 108 MHz and tune the receiver to each of the frequency. The dial meter pointer should be over the corresponding dial graduation.

(7) Muting Sensitivity

Place the Muting switch in "ON" position and apply input signal to the receiver antenna from SG.

Gradnally increase SG output, starting from zero output until audio output is obtained at TAPE REC jacks. The antenna input signal level should be 20 dBf $\pm$ 3 dBf.

(8) 50 dB Quieting Sensitivity (Sampling)

MONO 19.2 dBf

STEREO 39.0 dBf

Antenna input signal level required to produce 50 dB quieting sensitivity at 98 MHz, 1 KHz 75 KHz mono modulation.

In case of stereo mode, place the stereo SG in "L+R" position and adjust the SG to provide 9 % (6.75KHz) pilot signal modulation and 90 % (67.5 KHz) 1 KHz modulation.

(9) Frequency Response (Sampling)

30Hz - 15KHz : $^{+0.5}_{-2}$ dB

Let 400Hz = 0 dB

When the frequency responses measured are compared with each de-emphasis curve of 25 µs, 50 µs and 75 µs, the deviation from the standard curve should be within $^{+0.5}_{-2.0}$ dB.

(10) Spurious Response (Sampling)

at 98 MHz + 1/2 IF, 70 dB.

Adjust SG to provide 98 Mz + 1/2 IF and increase the SG output until the same noise output as the noise obtained at usable sensitivity input applied. Then the spurious response will be given as the difference between the SG output readings at 98 MHz and 98 MHz + 1/2 IF.

(11) IF Rejection (Sampling)

80 dB at 98 MHz

Measure in the similar way as above (10), using frequency of 10.7 MHz instead of 98 MHz + 1/2 IF.

(12) Image Rejection (Sampling)

50 dB at 98 MHz

Measure in the similar way as above (10), using image frequency (98 MHz + 2 IF) = 119.4 MHz

(13) Selectivity (Sampling)

50 dB at $\pm$ 400KHz

Connect SG # 1 (desired signal) and SG # 2 (interference signal) to the antenna terminals through a two signal matching pad. Temporarily adjust SG # 2 to zero output and SG # 1 to provide 98 MHz, 45 dBf with 1KHz 100 % mod. Tune the receiver to the SG # 1 frequency and note the receiver's Rec Output level as 0 dB reference level.

Remove the modulation signal from the SG # 1. Next, modulate SG # 2 with 1000 Hz 75 KHz deviation and adjust SG # 2 frequency to provide 98 MHz $\pm$ 400 KHz. Increase the SG #2 output until the Rec Output of the receiver reaches 30 dB below 0 dB reference level. Read the antenna input voltage (dB) under this condition and let it be equal B dBf. Then the slectivity will be given by the equation below:

Selectivity = B -45 (dB)

(14) Capture Ratio (Sampling)

Connect SG # 1 and SG #2 to the antenna circuit as shown in above (13). Tune both signal generator exactly to the receive frequency, 98 MHz.

Adjust SG # 1 to provide 65 dBf (= 60 dBu), 1 KHz 100 % modulation and SG # 2 no modulation.

Increase SG #2 output level until the receiver Rec. Output level decreases by 1 dB and read the SG # 2 output as (a) dB. Then, further increase the SG # 2 output until the Rec. Output level decreases by 29 dB (30 dB below initial level) and read the SG # 2 output as (b) dB. Then the capture ratio will be given as follow.

$$\text{Capture Ratio} = \frac{b - a}{2} \quad \text{(dB)}$$

Spec. 2.0 dB

(15) Tuning Range (100 % Test)

Spec. 87.5 - 108 MHz

(87.4 - 109 MHz alignment)

MPX Section

(1) Stereo Threshold Level (100% Test)

The stereo lamp should be lit up when the antenna input signal of 20 dBf $\pm$ 3 dB is applied from MPX SG.

(Pilot level : 9 %, 98 MHz)

(2) MPX Separation (100% Test)

Separation should be 45 dB when measured with 98 MHz, 65 dBf (60 dB), 1 KHz 75 KHz dev. input signal applied.

(3) 19 KHz, 3.8 KHz Carrier Leakage (100% Test)

In the above measurement, turn off the modulation signal and measure 19 KHz and 38 KHz carrier leakage provided at REC OUTPUT jacks. They should be attenuated as shown below (1 KHz output = 0 dB reference level).

Model	320R	330R	330R1
Limits	35 dB	58 dB	58 dB

Audio Section

(1) RMS Power (100 % Test)

Apply 0.5 V signal to the AUX jacks and adjust the amplifier volume control to provide the audio output of 10 W (9V). Next adjust the audio input to produce the audio outputs specified in the table below and measure the distortion.

It should be within the limits shown below.

	320R	330R/330RL
Freq. Response	Flat	Flat
Measurement Freq.	20Hz, 1KHz, 20KHz, 30KHz	20Hz, 1KHz, 20KHz, 30KHz
AF Output	15W(7.5W at 30KHz) for 8 18W(9W at 30KHz) for 4	25W(12.5W at 30KHz) for 8 30W(15W at 30KHz) for 4
Power Supply (USA)	117V $\pm$ 1 %	117V $\pm$ 1 %
Power Supply (Europe)	220V $\pm$ 1 %	220V $\pm$ 1 %
Distortion	0.2 %	0.1 %
Dummy Load	4Ω / 8Ω	4Ω / 8Ω
Note	Both CH	Both CH

(2) Mode Switch Check (100 % Test)

Place the mode switch in the stereo position and adjust the volume control to provide power output of 8 V as tabulated below.

Then place the mode switch in the Mono position and make sure the audio output specified in the table is obtained.

Conditions

AUX - SPKR (8 loaded), Both channels driven, Input Signal Impedance 5.1 KΩ.

	320R	330R/330RL
Freq. Response	Flat	Flat
Frequency	1 KHz	1 KHz
Output(Both CH)	8 V	8 V
MONO Output	6.8 V	7 V

(3) Separation

Adjust audio signal generator to provide 0.5 V input to the AUX jack, then adjust volume control to obtain audio power output of 10W (9V).

Feed audio signal input to the R CH AUX jack and adjust the signal input level until a half of rated audio power output is obtained at R CH output terminal.

Measure the signal leakage at L CH output terminal.

It should be less than the limit shown below.

Make the same test for R CH leakage.

Conditions AUX - Speaker (8 Ω)

PHONO - Speaker

Frequency Response : flat

Input : One CH input

Remaining Channel terminated with 1 KΩ

Test Frequency : 1 KHz, 100Hz, 10KHz

	320R		330R/330RL	
Condition / Freq.	PHONO-SPKR	AUX-SPKR	PHONO-SPKR	AUX-SPKR
100Hz	37 dB	37 dB	45 dB	55 dB
1KHz	45 dB	40 dB	50 dB	60 dB
10KHz	30 dB	34 dB	30 dB	40 dB

Make the similar measurement by applying input signal of 5 mV to the PHONO jack.

(4) Input Sensitivity (100 % Test)

Adjust volume control to its maximum position. Then, Apply audio signal to each left and right AUX (TAPE PLAY 1 & PHONO) jacks and adjust each input signal level until the rated output power is obtained at both channels.

Read the input signal levels, they should be within the following limits.

	320R	330R/330RL
Output Power	11.0 V	14.1 V
AUX	150mV $\pm$ 2dB	150mV $\pm$ 2dB
TAPE PLAY 1	150mV $\pm$ 2dB	150mV $\pm$ 2dB
PHONO	2.5mV $\pm$ 2dB	2.5mV $\pm$ 2dB

Dummy Load : 8Ω , F = 1 KHz

(5) Tape Output Voltage (Sampling)

Place the volume control in its max. position, then feed audio signal to the AUX jacks until the power output specified in the table below is obtained.

Measure tape output voltages at both TAPE OUTPUT jacks, they should be within the limit tabulated below.

Conditions :

AUX - SPKR

Volume : Max.

f : 1 KHz

	320R	330R 330RL
Power Output	11.0 V	14.2 V
Rec. Output	150mV$^{+}_{-}$3dB	150mV$^{+}_{-}$3dB

(6) Output Difference (Sampling)

Set the volume controls to their maximum position.

Apply audio input signals to the AUX jacks to produce specified power output (10V) obtained at one of two channels. Then measure the output voltage difference between the both channels. It should be within the following limit.

Conditions :

AUX - SPKR (8Ω)

Frequence Response : Flat

Volumes : Max Position

	320R	330R 330RL
Output Voltage	10 V	10 V
Voltage Difference	$^{+}_{-}$1.0 dB	$^{+}_{-}$0.5 dB

(7) Dynamic Range

Measure the input voltage levels causing 0.5 % distortion in both TAPE REC Outputs, using oscilloscope.

Conditions :

Volume Control : Min. Posi.

PHONO - TAPE REC.

	320R	330R 330RL
1 KHz	150 mV	150 mV
20 Hz	·23 mV	23 mV
20 KHz	1425 mV	1425 mV

(8) Hum and Noise (100 % Test)

Short-circuit each AUX. PHONO and TAPE PLAY 1 jacks and measure the noise output at speaker terminals. They should be less than the limits shown below when compared with the reference output voltage given in the table.

Conditions :

IHF "A" Network

Input circuit shorted

Volume MAX

	320R	330R 330RL
Output Ref. Volt	11.0 V	14.2 V
PHONO	70 dB	70 dB
AUX	85 dB	85 dB
TAPE PLAY 1	85 dB	85 dB

Note : Care must be given to ground lead connection of measurement equipment.

(9) Tone Control Response (100 % Test)

Set the Bass and Treble control to their mechanical center position and adjust the input signal level to produce power output voltage of 2 V, constant.

Make sure the frequency response over the band Of 40 Hz to 20 KHz is within $\pm$1 dB from the 1 KHz reference level.

Next, place the BASS and TREBEL controls in their MAX. and MIN. position and measure the output variations at 100 Hz and 10 KHz. They should be within the following limits.

100 Hz	$\pm$10 dB	$\pm$2 dB
10KHz	$\pm$10 dB	$\pm$2 dB

Conditions :

AUX - SPKR

LOUDNESS OFF

HI FILTER OFF

LO FILTER OFF

VOLUME MAX

LOAD 8 Ω

(10) LOUDNESS Control

Adjust volume control to give power output of 30 dB below the maximum power output, applying 1 KHz input signal. Place the Loudness Control in "ON" position and measure the left and right channel outputs at 100 Hz and 10 KHz.

They should be within the following limits.

Conditions :

AUX - SPKR

LOAD : 8Ω

OUTPUT : 2 V

Tone : Flat

	320R	330R, 330RL
100 Hz	+7dB ± 2dB	+7dB ± 2dB
10 KHz	+3.5dB ±2dB	+3.5dB ± 2dB

(11) Hi Filter

Place the Hi Filter switch in ON position and measure the output voltage at 8 KHz, it should be decreased by 6 dB ± 2 dB from 1 KHz, reference level.

Conditions : AUX - SPKR

LOAD : 8Ω

OUTPUT: 2V

TONE : Flat

(12) PHONO Equalizer

Adjust the input signal voltage so that constant output voltage of 1 V is obtained at REC OUT jacks. Measure the input voltage at each frequency shown below, they should be within the following limits.

Volume control should be placed in MIN. position.

20 Hz	+16.3 ± 0.5 dB
30 Hz	+17 ± 0.5 dB
50 Hz	+16.3 ± 0.5 dB
80 Hz	+14.2 ± 0.5 dB
100 Hz	+12.9 ± 0.5 dB
200 Hz	+ 8.2 ± 0.5 dB

300 Hz	+5.5	± 0.5 dB
500 Hz	+2.6	± 0.5 dB
700 Hz	+1.2	± 0.5 dB
2 KHz	-2.6	± 0.5 dB
3 KHz	-4.7	± 0.5 dB
5 KHz	-8.2	± 0.5 dB
7 KHz	-10.8	± 0.5 dB
10 KHz	-13.7	± 0.5 dB
15 KHz	-17.2	± 0.5 dB
20 KHz	-19.6	± 0.5 dB

(13) Distortion

Feed 0.5 V input signal to the AUX jacks and adjust volume control to produce power output of 10 W (8.9V). Next, decrease the input signal level so that the output level decreases by 16 dB (0.25 W = 1.4 V) and measure distortion at that output. The distortion should be less than the following limits at the test frequency of 20 Hz, 1 KHz and 20 KHz.

For 320R : 0.2 %

For 330R, 330RL : 0.1 %

Conditions : AUX - SPKR

LOAD : 8 Ω

(14) IM Distortion

Conditions :

AUX - SPKR

Both CH

	0.25W	MAX. Power
320R	0.2 %	0.2 %
330R, 330RL	0.1 %	0.1 %

(15) Volume Tracking

Apply input signal of 2 times the AUX input sensitivity to both AUX jacks and measure the speaker output voltages. The output voltage difference between the left and right channel should be within 3 dB.

Conditions : AUX - SPKR

Volume : 10 O'clock position

f : 1 KHz

Load : 8Ω

Freq. Response : Flat

(16) Power Limiter Check

Connect 2Ω loads tothe speaker terminals and make sure the power limiter operates as intended.

(17) Cross talk

Connect 0.5 V input signal (5 mV for PHONO jack) to one of input jacks and adjust the sound volume to provide 1 W (2.8 V) output power.

Next, adjust the input signal level so that the specified output voltage (1/2 rated power output) is obtained.

Place the Input Selector to the position other than the position where the input signal is applied.

The input jacks selected by the Input Selector should be terminated with 1 KΩ resistors.

Measure the leakage voltage at the output terminals, they should meet following limits. Repeat the test by applying the signal to the remaining input jacks.

	320R	330R, 330RL
20 Hz	34 dB	40 dB
1 KHz	40 dB	50 dB
10 KHz	34 dB	40 dB

(18) Amplifier Evaluation using Inductive Load & Square Wave

(Conditions)

(1) AUX - SPEAKER

(2) Power Supply - Rated voltage

(3) VR in MAX; Tone Controls in Flat; All Filters in OFF.

(4) Adjust square wave input signal level to provide the audio output (p-p) equal to 70 % DC voltage supplied at no load.

(5) Operate the receiver for 30 minutes with the following load condition.

Load Condition for each channel

A. Three each 4 mH inductor and 1.0Ω resistor connected in series.

B. The parts should be housed properly with terminals prepared.

a. Resistor : 1Ω, non-inductive, 1/4 rated output power

b. Inductor : 4mH (# 14 AWG wire)

(Results)

No defect should be occured.

(19) Damping Factor (Sampling)

Measure output voltage (A) at speaker terminals with no load connected & Tone Controls set in center position.

Next, measure the output voltage (B) with 8Ω load connected.

$$\text{Damping factor} = \frac{B}{A - B}$$

Spec. 320R : 40 or higher

330R : 45 or higher

330RL : 45 or higher

Note : Adjust input signal level so that the power output of A = 1 V is obtained.

PSAA004COX

Q1 3SK73(Y)

Q2 2SC535(B,C)

Q3 2SC1923(O,R)

Q4 2SC1923

FM 300Ω

FM 75Ω

AM

LW SAME 530TL

LW BLACK

Q10 2SC2240(BL)

IC 3 HA1197

Q11 2SC1815 (Y,GR)

Q13,14 2SA970 (GR,BL)

Q15,16,17,18 2SC2240 (GR,BL)

Q19,20 2SC2240 (BL)

Q41 2SC1815 (Y,GR)

Q42 2SC2240(BL)

Q43 2SA970 (BL)

Q44 2SD526 (O,Y)

Q45 2SK30A (GR)

AUX

PHONO

MUTE

FM

MW

NOTE : 1. ALL VOLTAGES MEASURED FROM COMMON NEGATIVE CHASSIS GROUND WITH VTVM AT NO SIGNAL.
2. CAPACITORS VALUES ARE IN μF UNLESS OTHERWISE NOTED P = PICO FARAD
3. RESISTORS VALUES ARE IN OHM K = K OHM
4. VOLTAGES IN ( ) WHEN MUTE ON
5. VOLTAGES IN ( ) WHEN AM

330R - 320R

SCHEMATIC DIAGRAM MODEL

Q3
C1923(O,R)

Q4
2SC1923(O,R)

M2
CENTER
METER

M1
SIGNAL
METER

IC 1 HA1137W
or AN317

IC 2 HA1196

PSLD018COX

PSSW073COX

Q5
2SC1815
(Y,GR)

Q6
2SA1015
(Y,GR)

Q11
2SC1815
(Y,GR)

Q19,20
2SC2240
(BL)

Q21,22
2SC2240
(GR,BL)

Q25,26
2SA798 (F,G)

Q29,30
2SC1318(Q,R)

Q33,34
2SC1627A(O,Y)

Q37,38
2SC1986(O,Y)

Q27,28
2SC2229(Y)

Q31,32
2SA720(Q,R)

Q35,36
2SA817A(O,Y)

Q39,40
2SA771(O,Y)

Q41
2SC1815
(Y,GR)

Q42 2SC2240(BL)

Q43 2SA970(BL)

Q44 2SD526 (O,Y)

Q45
2SK30A
(GR)

PSAZ025COX

J4 P1

J5
F5
3.5A

J6
F6
3.5A

J7
F4
1.25A

J1

J2

J3

PT1

SCHEMATIC DIAGRAM MODEL 330 R (E)

1978 7:19

EDIT.

年月日	担当	変更内容

M2 CENTER METER

M1 SIGNAL METER

IC 1 HA1137W or AN377

HA1196

PSLD018COX

PSSW073COX

PSAZ025COX

Q5 2SC1815 (Y,GR)

Q6 2SA1015 (Y,GR)

Q25, 26 2SA798 (F,G) | Q29, 30 2SC1318 (Q,R) | Q33, 34 2SC1627A (O,Y) | Q37, 38 2SC1986 (O,Y)

Q27, 28 2SC2229 (Y) | Q31, 32 2SA720 (Q,R) | Q35, 36 2SA817A (O,Y) | Q39, 40 2SA771 (O,Y)

Q21, 22 2SC2240 (GR, BL)

SEMICONDUCTOR TERMINAL CONNECTION

2SC535 2SC1923
2SC1815 2SC2240
2SA970 2SC1318
2SA720 2SA1015

2SA771
2SC1986
2SD526

2SA817A
2SC1627A

2SA798

2SK30A

3SK73

HA1137W
HA1196
HA1197

E: EMITTER S: SOURCE
C: COLLECTOR G: GATE
B: BASE D: DRAIN

330 R (E)

1978. 7. 10

EDIT.